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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,005	03/18/2004	John Edwin Berberian	10030089-1	7780

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AGILENT TECHNOLOGIES, INC.  
Legal Department, DL 429  
Intellectual Property Administration  
P.O. Box 7599  
Loveland, CO 80537-0599

EXAMINER

GOODLEY, JAMES E

ART UNIT	PAPER NUMBER
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2817

DATE MAILED: 03/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

H:A

<b>Office Action Summary</b>	<b>Application No.</b> 10/805,005	<b>Applicant(s)</b> BERBERIAN ET AL.	
	<b>Examiner</b> James E. Goodley	<b>Art Unit</b> 2817	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 11/4/2005
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 5-11, 13-14 and 16-22 are rejected under 35 U.S.C. 102(b) as being anticipated by ***Vanier (US 6,320,472)***.

Regarding **claims 1-3, 7, 10-11, 13-14, 18 and 21-22**, Figs. 5 and 7 and columns 6- 8 of Vanier show an apparatus comprising:

a quantum absorber [resonance cell 100 of CPT optical package] comprising a material having first and second low energy states [F=3, F=4] coupled to a common high energy state [P state] (as shown in Fig. 2 for Cesium gas), transitions between said first low energy state and said common high energy state or between said second low energy state being induced by electromagnetic radiation (via laser light injected into the absorber and influence of solenoid 114);

an electromagnetic radiation source [laser 105] that generates electromagnetic radiation having first and second CPT-generating frequency components (corresponding to transitions between F=3 and F=4 to P states), said first CPT-generating frequency component having a frequency  $u_L - u$  (where  $u_L$  is the average frequency between the F=3 and F=4 states and  $u = \mu/2$ ; where  $\mu$  is the frequency

difference between the two lower CPT states), and a first CPT component amplitude and said second CPT-generating frequency component having a frequency  $\nu_L + \nu$  and a second CPT component amplitude, said first and second CPT-generating frequency components irradiating said quantum absorber;

a detector ['Lock-In Detector' of loops 1 and 2] for generating a detector signal related to the power of electromagnetic radiation that leaves said quantum absorber, said detector signal exhibiting an asymmetry as a function of frequency  $\nu$  in a frequency range about a frequency  $\nu_0$  (as shown in Fig. 8A, where there is an asymmetry about diode current  $i_0$ , in which the diode detects signal  $i_0$  proportional to the light emitted by the laser);

a CPT servo loop [loops 1 and 2] that alters  $\nu$  in response to said detector signal; and

an asymmetry servo loop [loops 1 and 2] that alters one of  $\nu_L$ , said first CPT component amplitude, and said second CPT component amplitude in a manner that reduces said asymmetry (as loops 1 and 2 alter diode currents about  $i_0$  shown in the curve in Fig. 8A to an appropriate level and feeding said currents back to the laser to lock the laser frequency to the resonance frequency corresponding to transitions between F and P states – lines 15-30 of column 8).

Regarding **claims 5 and 6**, Vanier discloses the apparatus of claim 1 wherein said electromagnetic radiation source comprises: a source [laser 105] that generates electromagnetic radiation having a frequency  $\nu_L$  in response to a first signal (output from laser current driver); and a modulator [107 Hz modulator of loop 1] that modulates

said generated electromagnetic radiation at a frequency determined by a second control signal [signal output from signal adder of loop 1 and passed through Microwave RF generator]; and

wherein said modulator also modulates the phase or frequency and amplitude of said generated radiation in a manner determined by a third control signal [signal output from signal adder of loop 2] and wherein said asymmetry servo loop alters one of said second and third control signals.

Regarding **claims 8 and 19**, the abstract of Vanier discloses the apparatus of claim 1 and method of claim 13, wherein said electromagnetic radiation source comprises first and second phase-locked lasers.

Regarding **claims 9 and 20**, Vanier discloses the apparatus of claim 1 and method of claim 13, wherein the first and second energy states of said quantum absorber differ in energy by an amount that is a function of the externally applied electromagnetic field from the laser light source.

Regarding **claims 16 and 17**, Fig. 7 of Vanier discloses the method of claim 13, wherein said electromagnetic radiation is generated via modulating the laser frequency at a frequency  $\omega$  about  $\omega_L$  (via modulation feedback loops 1 and 2).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vanier in view of ***Zhu et al. (US 6,363,091)***, ***hereinafter "Zhu"***.

Regarding **claims 4 and 15**, Vanier discloses the apparatus of claim 1 except, "wherein said electromagnetic radiation source further generates additional frequency components for altering an AC Stark shift in said quantum absorber, said additional frequency components having amplitudes and/or frequencies that are determined by a Stark shift control signal, and wherein said apparatus further comprises an AC Stark shift servo loop for generating said Stark shift control signal."

However, Fig. 7 and the abstract of Zhu disclose an atomic oscillator system in which stark shift frequency components are generated by a laser [light source 102] and a quantum absorber [104]. AC stark shift detector 261 and spectrum control 214 are included in feedback loop in order reduce the magnitude of AC stark shift by altering the spectrum of the control signal [224] to the laser.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Vanier by including an AC stark shift feedback control loop like that of Zhu for the purpose of reducing undesired AC stark shift effects created in the CPT system from the laser and quantum absorber of Vanier.

Claims 12 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vanier.

Regarding **claims 12 and 23**, Vanier discloses the apparatus of claim 10 and method of claim 21 except, "wherein said ion is an isotope selected from the group

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consisting of Be.sup.+, Mg.sup.+, Ca.sup.+, Sr.sup.+, Ba.sup.+, Zn.sup.+, Cd.sup.+, Hg.sup.+, and Yb.sup.+.”

The applicant has not stated any proposed reason why the isotopes listed above are preferable over Cesium or Rubidium. Furthermore, as the applicant has noted in paragraph 44 of the specification, any material maybe be used for the quantum absorber may be used which exhibits CPT effect.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Vanier by utilizing any of the above isotopes as the quantum absorber instead of Cesium or Rubidium.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

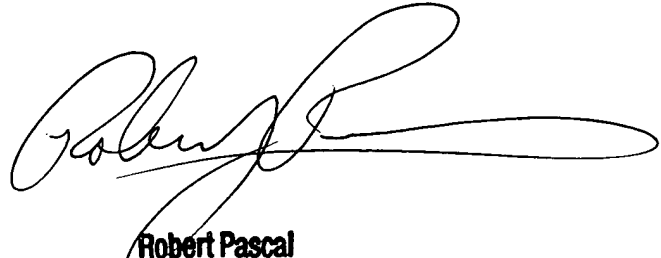
***Zhu (US 6,993,058), hereinafter “Zhu 2” and Dowd et al. (US 7,003,438)*** both disclose methods for laser frequency stabilization in CPT atomic resonance systems.

### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James E. Goodley whose telephone number is (571)-272-8598. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert J. Pascal can be reached on (571)272-1769. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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